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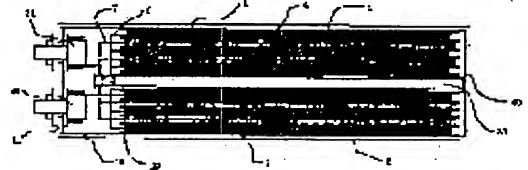
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(54) NONAQUEOUS ELECTROLYTE SECONDARY BATTERY

(57)Abstract:

PROBLEM TO BE SOLVED: To uniformly apply battery internal pressure induced by sudden heating by an internal short circuit to the inside of a battery, and to more reliably actuate a safety valve by communicating upper end surface side and lower end surface side spaces of an electrode body by a hollow electrode body core, and arranging at least a single pressure relief part on an end part peripheral surface of the electrode body core.

SOLUTION: An electrode body 2 by winding a positive electrode plate 3 and a negative electrode plate 4 round a stainless steel core 30 through a separator 5 is inserted into a battery case 1, and a battery lid 11 having positive/negative electrode terminals 31 and 32 is welded to the battery case 1, and an electrolyte is filled/sealed in a vacuum. A safety valve 40 is arranged on a bottom surface of the battery case 1. Circular through holes communicated with an inside surface of the core 30, that is, pressure relief parts 20 are oppositely formed by two pieces on an end part peripheral surface positioned on the battery lid 11 side of the electrode body 2 of the core 30. Therefore, the safety valve 40 can be reliably actuated without straining the battery lid 11 and the battery case 1.



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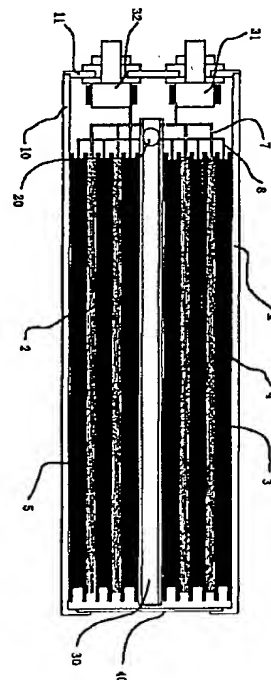
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(54) 【発明の名称】 非水電解質二次電池

(57) 【要約】

【課題】 より安全性に優れた非水電解質二次電池を提供する。

【解決手段】 本発明になる非水電解質二次電池は、巻回された電極体が電池容器に収納されており、電池蓋又は／及び電池容器と電極体上部端面とで囲まれる第1の空間と、電池蓋又は／及び電池容器と電極体下部短面とで囲まれる第2の空間と、第2の空間に面する電池蓋又は／及び電池容器に設けられた安全弁と、前記安全弁の設けられていない第1の空間に設けられた正極端子と負極端子と、前記第1の空間と第2の空間とを連通する連通手段を備えており、前記連通手段が、中空状の電極体巻芯であって、かつその端部周囲に少なくとも1つの圧力逃げ部が設けられてなることを特徴とする。



【特許請求の範囲】

【請求項1】 巻回された電極体が電池容器に収納されてなる非水電解質二次電池において、電池蓋又は／及び電池容器と電極体上部端面とで囲まれる第1の空間と、電池蓋又は／及び電池容器と電極体下部端面とで囲まれる第2の空間と、第2の空間に面する電池蓋又は／及び電池容器に設けられた安全弁と、前記安全弁の設けられていない第1の空間に面する電池蓋又は／及び電池容器に設けられた正極端子及び負極端子と、前記第1の空間と第2の空間とを連通する連通手段とを備えており、前記連通手段が、中空状の電極体巻芯であって、かつその端部周面に少なくとも1つの圧力逃げ部が設けられてなることを特徴とする非水電解質二次電池。

【請求項2】 巻回された電極体が電池容器に収納されてなる非水電解質二次電池において、電池蓋又は／及び電池容器と電極体上部端面とで囲まれる空間と、前記空間に面する電池蓋又は／及び電池容器に設けられた正極端子及び負極端子と、電極体下部端面に対向する電池蓋又は／及び電池容器に設けられた安全弁と、前記空間から前記安全弁内側へ連通させる連通手段とを備えており、前記連通手段が、中空状の電極体巻芯であって、かつその端部周面に少なくとも1つの圧力逃げ部が設けられてなることを特徴とする非水電解質二次電池。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、非水電解質二次電池に関し、特に安全性の向上に関する。

【0002】

【従来の技術】近年、電子機器の発展に伴って、高エネルギー密度の電池が市場から強く求められており、ニッケル・水素電池、リチウムイオン電池などのエネルギー密度の高い二次電池が実用化されてきた。また、自動車の排気ガスによる環境問題などから、電気自動車の開発が盛んにおこなわれており、電気自動車用の高エネルギー密度大型二次電池の開発も併せて各社で進められている。一個の電池を大容量とした場合には、複数の小容量の電池を並列に接続した場合よりも、容量当たりのコストを削減することができ、また、電池全体に占める電池ケースの体積、重量の比を小さくすることができるため、より高エネルギー密度の電池を提供することができる。よって、非水電解質二次電池は、高エネルギー密度に優れるという特徴を有しており、携帯電話等の電子機器用電源から、さらには電動車両用電源等に好適である。

【0003】このような非水電解質二次電池において、充電状態で釘差し試験、圧壊試験などの安全性試験をおこなった場合、内部短絡箇所に流れる電流は電極表面積に比例して大きくなるので、とくに電極表面積の大きい

大型の高エネルギー密度電池では、電池内の短絡箇所に非常に大きな電流が流れて急激な発熱が生じる。そして、電解液が気化して電池の内圧が急速に上昇し、電池の破損に至る可能性があった。一般に、大型の非水電解質二次電池では、次のように作製される。すなわち上述の正極活物質および負極材料にそれぞれ結着剤を混合し、ペースト状にしてそれぞれ金属箔に塗布、乾燥する。そして、圧延し、所定の寸法にカットする。次に、セパレータ等の隔離体を介して渦巻状に巻回し、その電極体の最外周をテープで巻き止めする。この電極体を円筒状の電池ケースに収納し、円筒両端を電池蓋により密封する。このとき、電池蓋の一方に正極端子が、もう一方に負極端子が設けられており、密封前に、電極に接続された複数の集電リードを束ね、それぞれの端子にそのリードを接続している。したがって、電池蓋内面と電極端面との間には、リードを接続する端子とリード自身の占有空間が必要となるため、電池の両端にそれぞれ前記の占有空間が存在することとなる。

【0004】

【発明が解決しようとする課題】このような構造を有する非水電解質二次電池では、前記のように、万一の不測の事態が起こったときに電池の破損を防ぐため、電池両端の電池蓋に安全弁を設ける必要がある。しかしながら、安全弁を設けたとしても、安全弁を設ける電池蓋には端子があるため、十分な開口面積を採ることができないといった問題があり、より安全性を求めるためには複数個の安全弁を設けなければならないといった問題も生じる。

【0005】それに加えて、安全弁に面する機器に対しても、安全弁作動時の対策を取る必要がある。しかし、機器側の制約から十分な対策が取り難いといった問題もある。

【0006】そこで、本発明は、上記問題点を解決するためになされたものであり、電極表面積の大きい大型電池においてさえ、万一の不測の事態が生じた場合でも、内部短絡による急激な発熱で誘引される、電池の内圧を電池内部で均一にかけることができるとともに、安全弁の作動をより確実に作動させることができる、安価で、より安全性の優れた非水電解質二次電池を提供することを目的とする。

【0007】

【課題を解決するための手段】本発明は、巻回された電極体が電池容器に収納されてなる非水電解質二次電池において、電池蓋又は／及び電池容器と電極体上部端面とで囲まれる第1の空間と、電池蓋又は／及び電池容器と電極体下部端面とで囲まれる第2の空間と、第2の空間に面する電池蓋又は／及び電池容器に設けられた安全弁と、前記安全弁の設けられていない第1の空間に面する電池蓋又は／及び電池容器に設けられた正極端子及び負極端子と、前記第1の空間と第2の空間とを連通する連

通手段とを備えており、前記連通手段が、中空状の電極体巻芯であって、かつその端部周面に少なくとも1つの圧力逃げ部が設けられてなることを特徴とする。

【0008】第2の本発明は、巻回された電極体が電池容器に収納されてなる非水電解質二次電池において、電池蓋又は／及び電池容器と電極体上部端面とで囲まれる空間と、前記空間に面する電池蓋又は／及び電池容器に設けられた正極端子及び負極端子と、電極体下部端面に対向する電池蓋又は／及び電池容器に設けられた安全弁と、前記空間から前記安全弁内側へ連通させる連通手段とを備えており、前記連通手段が、中空状の電極体巻芯であって、かつその端部周面に少なくとも1つの圧力逃げ部が設けられてなることを特徴とする。

【0009】なお、中空状電極体巻芯の端部とは、その巻芯の両端であってもよいし、一方だけであってもよい。

【0010】

【発明の実施の形態】以下本発明を好適な一実施の形態に基づき詳述する。

【0011】図1は、直径66mm、高さ250mm、設計容量50Ahの本発明になる非水電解質二次電池の断面説明図である。

【0012】正極板3は、次のように作製した。すなわち、厚み20ミクロンのアルミ箔の両面にコバルト酸リチウム85重量部と導電剤であるグラファイト7重量部および結着剤としてポリテトラフルオロエチレン8重量部とを混合し、溶媒としてのn-メチル-2-ピロリドンに適宜加え、ペースト状にして塗布、乾燥した。そして圧延を施して幅185mm、厚み0.25mmの寸法にし、この極板の長手方向端部の活物質層を一部除去してアルミニウム製の正極リード7を一定の間隔で複数個、超音波溶接機にて取り付け付けた。

【0013】負極板4は、次のように製作した。すなわち、厚み18ミクロンの銅箔の両面にリチウムをドーブ・脱ドーブ可能な人造黒鉛90重量部と結着剤としてポリフッ化ビニリデン10重量部を混合し、溶媒としてのn-メチル-2-ピロリドンに適宜加え、ペースト状にして塗布、乾燥した。そして圧延して幅200mm、厚み0.2mmの寸法にし、この極板の長手方向端部の活物質層を一部除去して銅箔からなる負極リード8を複数個、超音波溶接機にて取り付け付けた。

【0014】電極体2は次のように製作した。すなわち、正極板3と負極板4とを真空中にて120℃で10時間乾燥した後、セパレータ5を介して渦巻状に巻回し、粘着テープで巻き止めし、電極体2を作製した。なお、セパレータ5は幅210mm、厚み45ミクロンのポリエチレン樹脂製微多孔膜を用いた。

【0015】このとき、電極体の巻芯30としてステンレスよりなる、長さ220mm、内径12mm中空状のパイプを用い、かつ中空状パイプの電極体2の上部端面側に

位置する端部周面には、パイプ内面に連通した10mm径の円形状貫通孔、すなわち圧力逃げ部20が対向するよう、2個形成されている。ここでは円形状であるが、これに限るものでなく、楕円形状、四角形状、U字状、V字状などが例示される。

【0016】非水電解質二次電池1は、次のように製作した。すなわち、電極体2を電池ケース10内に挿入して、正極リード7および負極リード8をそれぞれ束ね、蓋板11の端子31、32にそれぞれ溶接にて取り付け、それらの端子31、32を蓋板11に取付けた。そして、蓋板11を電池容器10に溶接し、電解液を真空注液して密封した。(注液口は図示せず)このとき、電池容器底面12に安全弁が設けられている。これを本発明になる電池とする。ここでは電池容器が有底筒状体であるが、筒体に底面電池蓋を溶接して有底筒状体としてもよい。

【0017】なお、安全弁40は直径60mm、厚さ0.25mmの円形状ステンレス製薄膜であって、その周縁が蓋板に溶接されたものである。

【0018】なお、電解液には、エチレンカーボネートとジエチルカーボネートとの混合溶媒中に六フッ化リン酸リチウムを1モル/1の割合で溶解したものをを用いた。

【0019】〔比較例1〕正極3と負極4とをセパレータ5を介して渦巻状に巻回し、粘着テープで巻き止めして本発明電池と同様にして電池を組み立てた。ただし、電極体巻芯の端部周面に圧力逃げ部20が設けられていない点で相違する。この電池を比較例電池とする。

【0020】〔実験〕本発明になる電池及び従来から公知の比較例の電池とを用いて、つぎのような安全性の比較試験をおこなった。これらの電池を、室温において、7時間かけて4.1Vまで定電流定電圧充電した後、1mm径の針を電池に刺して貫通させた。その結果、本発明になる電池においては速やかに安全弁が作動するとともに発煙はみられなかった。しかしながら、従来から公知の電池においては安全弁の付いていない方の電池蓋及び電池容器の形状が歪み、続いて安全弁が作動した。よって、本発明になる電池では、従来から公知の比較例電池よりも安全性に優れていることがわかるとともに、機器への安全弁対策も安全弁の付いている側だけに施せば足りる。また、電池の正負極端子が同一空間に面する電池蓋又は／及び電池容器に設けられているため、電池のスペース効率に優れるとともに、かつ端子と安全弁との設置場所が異なるため、安全弁の開口面積を増やすことができる。なお、巻芯30の中空内面に螺旋状の溝を設けることにより、安全弁の作動時間をさらに短縮することができた。

【0021】本発明においては、非水電解質二次電池の構成としては、上述の正極、負極及びセパレータとの渦巻状電極体と非水電解液との組み合わせの他に、正極、

負極及び有機固体電解質との渦巻状電極体と非水電解液との組み合わせであってもよいし、特に限定されるものではない。

【0022】

【発明の効果】以上述べたように、本発明になる非水電解質二次電池は、電極表面積の大きい大型電池においてさえ、万一の不測の事態が生じた場合でも、内部短絡による急激な発熱で誘引される電池の内圧を電池内部で均一にかけることができるとともに、安全弁の作動をより確実にすることができる。加えて、スペース効率に優れ、しかも安価な高容量非水電解質二次電池を提供することができる。

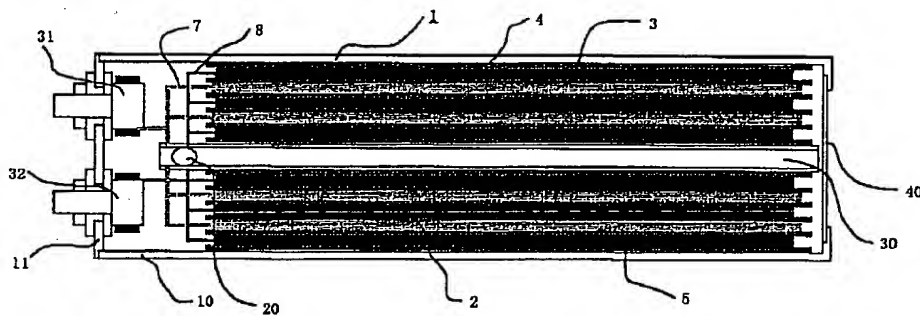
【図面の簡単な説明】

【図1】本発明になる一実施例にかかる円筒形非水電解質二次電池の断面模式図である。

【符号の説明】

- 1 円筒形非水電解質二次電池
- 2 電極体
- 3 正極板
- 4 負極板
- 5 セパレータ
- 7 正極リード
- 8 負極リード
- 10 電池容器
- 11 電池蓋
- 20 圧力逃げ部
- 30 巻芯
- 31 正極端子
- 32 負極端子
- 40 安全弁

【図1】



JAPANESE

[JP,11-154500,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION
MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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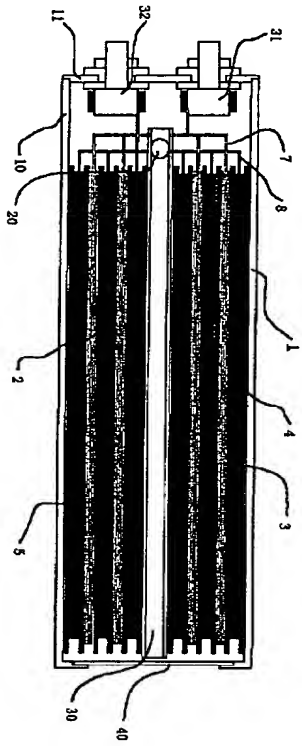
CLAIMS

[Claim(s)]

[Claim 1] In the nonaqueous electrolyte rechargeable battery with which a cell container comes to contain the wound electrode object The 1st space surrounded by the cell lid or/and the cell container, and the electrode object up end face, The 2nd space surrounded by the cell lid or/and the cell container, and the electrode object lower end face, The relief valve prepared in the cell lid or/and cell container facing the 2nd space, The positive-electrode terminal and negative-electrode terminal which were prepared in the cell lid or/and cell container facing the 1st space in which said relief valve is not prepared, The nonaqueous electrolyte rechargeable battery which is equipped with a free passage means to open said the 1st space and 2nd space for free passage, and said free passage means is a hollow-like electrode object winding core, and is characterized by coming to prepare at least one pressure roll off in the edge peripheral surface.

[Claim 2] In the nonaqueous electrolyte rechargeable battery with which a cell container comes to contain the wound electrode object The space surrounded by the cell lid or/and the cell container, and the electrode object up end face, and the positive-electrode terminal and negative-electrode terminal prepared in the cell lid or/and cell container facing said space, The relief valve prepared in the cell lid or/and cell container which counter an electrode object lower end face, The nonaqueous electrolyte rechargeable battery which is equipped with the free passage means made to open for free passage to said relief valve inside from said space, and said free passage means is a hollow-like electrode object winding core, and is characterized by coming to prepare at least one pressure roll off in the edge peripheral surface.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention relates to improvement in safety about a nonaqueous electrolyte rechargeable battery.

[0002]

[Description of the Prior Art] The cell of a high energy consistency is strongly called for from the commercial scene with development of electronic equipment in recent years, and the rechargeable battery with the high energy density of a nickel hydride battery, a lithium ion battery, etc. has been put in practical use. Moreover, from the environmental problem by the exhaust gas of an automobile etc., development of an electric vehicle is performed briskly, and development of the high energy consistency large-sized rechargeable battery for electric vehicles is also furthered collectively in each company. Since the volume of the cell case which can reduce the cost per capacity and is occupied on the whole cell rather than the case where the cell of two or more small capacity is connected to juxtaposition, and the ratio of weight can be made small when the cell of a piece is used as large capacity, the cell of a high energy consistency can be offered more. Therefore, the nonaqueous electrolyte rechargeable battery has the description of excelling in a high energy consistency, and is still more suitable for the power source both for a motor car etc. from power sources for electronic equipment, such as a cellular phone.

[0003] In such a nonaqueous electrolyte rechargeable battery, since the current which flows in an internal short circuit part becomes large in proportion to an electrode surface product when safety tests, such as a pegging test and a collapse trial, are performed in the state of charge, by the large, large-sized high energy consistency cell of especially an electrode surface product, a very big current flows in the short circuit part in a cell, and rapid generation of heat arises. And the electrolytic solution evaporated, and the internal pressure of a cell may have risen quickly and may have resulted in breakage of a cell. Generally, in a large-sized nonaqueous electrolyte rechargeable battery, it is produced as follows. That is, a binder is mixed, respectively into above-mentioned positive active material and an above-mentioned negative-electrode ingredient, and it is made the shape of a paste, and applies and dries to a metallic foil, respectively. And it rolls out and cuts into a predetermined dimension. Next, the stop of the outermost periphery of winding and its electrode object is spirally rolled and carried out on a tape through separators, such as a separator. This electrode object is contained in a cylinder-like cell case, and cylinder both ends are sealed with a cell lid. At this time, a positive-electrode terminal is prepared in one side of a cell lid, the negative-electrode terminal is prepared in another side, and that lead is connected to each terminal for two or more current collection leads connected to the electrode before seal in the bundle. Therefore, since occupancy space of a lead the terminal which connects a lead, and own is needed between a cell lid inside and an electrode end face, the aforementioned occupancy space will exist in the both ends of a cell, respectively.

[0004]

[Object of the Invention is carried out.] In the nonaqueous electrolyte rechargeable battery which has such structure, when the unexpected emergency situation happens as mentioned above, in order to prevent breakage of a cell, it is necessary to prepare a relief valve in the cell lid of cell both ends. However, there is a problem that sufficient opening area cannot be taken since there is a terminal in the cell lid which prepares a relief valve even if it prepares a relief valve, and in order to ask for safety more, the problem that two or more relief valves must be prepared is also produced.

[0005] In addition to it, it is necessary also to the device facing a relief valve to take the measures at the time of relief valve actuation. However, there is also a problem of being hard to take sufficient measures from the constraint by the side of a device.

[0006] Then, it is made in order that this invention may solve the above-mentioned trouble. Even when the unexpected emergency situation arises, while being able to apply to homogeneity the internal pressure of a cell attracted by rapid generation of heat by the internal short circuit inside a cell even in the large large-sized cell of an electrode surface product It aims at offering the nonaqueous electrolyte [which can operate actuation of a relief valve more certainly] rechargeable battery which was cheap and was more excellent in safety.

[0007]

[Means for Solving the Problem] In the nonaqueous electrolyte rechargeable battery with which a cell container comes to contain the electrode object around which this invention was wound The 1st space surrounded by the cell lid or/and the cell container, and the electrode object up end face, The 2nd space surrounded by the cell lid or/and the cell container, and the electrode object lower end face, The relief valve prepared in the cell lid or/and cell container facing the 2nd space, The positive-electrode terminal and negative-electrode terminal which were prepared in the cell lid or/and cell container facing the 1st space in which said relief valve is not prepared, It has a free passage means to open said the 1st space and 2nd space for free passage, and said free passage means is a hollow-like electrode object winding core, and it is characterized by coming to prepare at least one pressure roll off in the edge peripheral surface.

[0008] In the nonaqueous electrolyte rechargeable battery with which a cell container comes to contain the electrode object around which the 2nd this invention was wound The space surrounded by the cell lid or/and the cell container, and the electrode object up end face, and the positive-electrode terminal and negative-electrode terminal prepared in the cell lid or/and cell container facing said space, The relief valve prepared in the cell lid or/and cell container which counter an electrode object lower end face, It has the free passage means made to open for free passage to said relief valve inside from said space, and said free passage means is a hollow-like electrode object winding core, and it is characterized by coming to prepare at least one pressure roll off in the edge peripheral surface.

[0009] In addition, the edges of a hollow-like electrode object winding core may be the both ends of the winding core, and may be only one side.

[0010]

[Embodiment of the Invention] This invention is explained in full detail based on the gestalt of suitable 1 operation below.

[0011] Drawing 1 is the cross-section explanatory view of the diameter of 66mm, height of 250mm, and the nonaqueous electrolyte rechargeable battery that becomes this invention of design-capacity 50Ah.
 [0012] The positive-electrode plate 3 was produced as follows. That is, the polytetrafluoroethylene 8 weight section was mixed to both sides of aluminum foil with a thickness of 20 microns as the cobalt acid lithium 85 weight section, the graphite 7 weight section which is an electric conduction agent, and a binder, and the n-methyl-2-pyrrolidone as a solvent was added suitably, and it was made the shape of a paste, and applied and dried. And it rolled out, and was made width of face of 185mm, and a dimension with a thickness of 0.25mm, a part of active material layer of the longitudinal direction edge of this plate was removed, and two or more positive-electrode leads 7 made from aluminum were attached with the ultrasonic welding machine at fixed spacing.

[0013] The negative-electrode plate 4 was manufactured as follows. That is, the polyvinylidene fluoride 10 weight section was mixed to both sides of copper foil with a thickness of 18 microns as the artificial-graphite 90 weight section in which a dope and a dedope of a lithium are possible, and a binder, the n-methyl-2-pyrrolidone as a solvent was suitably added to them, and it was made them at the shape of a paste, and applied and dried. And it rolled out, and was made width of face of 200mm, and a dimension with a thickness of 0.2mm, and two or more negative-electrode leads 8 which remove a part of active material layer of the longitudinal direction edge of this plate, and consist of copper foil were attached with the ultrasonic welding machine.

[0014] The electrode object 2 was manufactured as follows. That is, after drying the positive-electrode plate 3 and the negative-electrode plate 4 at 120 degrees C in a vacuum for 10 hours, the stop was spirally wound and carried out with winding and adhesive tape through the separator 5, and the electrode object 2 was produced. In addition, the separator 5 used the fine porosity film with a width of face [of 210mm], and a thickness of 45 microns made of polyethylene resin.

[0015] At this time, two pieces are formed in the edge peripheral surface which consists of stainless steel as a winding core 30 of an electrode object and which is located in the up end-face side of the electrode object 2 of a hollow-like pipe, using the pipe of the shape of die length of 220mm, and bore hollow of 12mm so that it may counter, the circle configuration through tube 20, i.e., the pressure roll off, of the diameter of 10mm which was open for free passage to the pipe inside. Here, although it is a circle configuration, it does not restrict to this and the

shape of the shape of the shape of elliptical and a square and U character and V character etc. is illustrated.

[0016] The nonaqueous electrolyte rechargeable battery 1 was manufactured as follows. That is, the electrode object 2 was inserted into the cell case 10, the positive-electrode lead 7 and the negative-electrode lead 8 were attached in the terminals 31 and 32 of a cover plate 11 by welding in the bundle, respectively, and those terminals 31 and 32 were attached in the cover plate 11. And the cover plate 11 was welded to the cell container 10, it carried out vacuum pouring in and the electrolytic solution was sealed. (not shown [pouring-in opening]) At this time, the relief valve is prepared in the cell container base 12. Let this be the cell which becomes this invention. Although a cell container is a cylinder-like-object-with-base-like object here, a base cell lid is welded to a barrel and it is good also as a cylinder-like-object-with-base-like object.

[0017] In addition, a relief valve 40 is a thin film made from circle configuration stainless steel with a diameter [of 60mm], and a thickness of 0.25mm, and the periphery is welded to a cover plate.

[0018] In addition, what dissolved the 6 phosphorus-fluoride acid lithium in the electrolytic solution at a rate of one mol/l. into the mixed solvent of ethylene carbonate and diethyl carbonate was used.

[0019] The stop of the [example 1 of comparison] positive electrode 3 and the negative electrode 4 was spirally rolled and carried out with winding and adhesive tape through the separator 5, and the cell as well as this invention cell was assembled. However, it is different from the edge peripheral surface of an electrode object winding core in that the pressure roll off 20 is not formed. Let this cell be an example cell of a comparison.

[0020] The comparative study of the following safeties was performed using the cell of the well-known example of a comparison from the cell which becomes [experiment] this invention, and the former. After carrying out constant current constant-potential charge of these cells to 4.1V over 7 hours in a room temperature, the cell was stabbed with the needle of the diameter of 1mm, and was made to penetrate it. Consequently, emitting smoke was not seen while the relief valve operated promptly in the cell which becomes this invention. However, the configuration of the cell lid of the direction to which a relief valve is not attached in the well-known cell from the former, and a cell container continued, and the relief valve operated. Therefore, while the former shows excelling the well-known example cell of a comparison in safety, the cell which becomes this invention is sufficient if the measures against a relief valve to a device are also taken only against the side to which the relief valve is attached. Moreover, since the installations of a terminal and a relief valve differ since it is prepared in the cell lid or/and cell container with which the forward negative-electrode terminal of a cell faces the same space while excelling in the space efficiency of a cell and, the opening area of a relief valve can be increased. In addition, the operating time of a relief valve was able to be further shortened by establishing a spiral slot in the hollow inside of a winding core 30.

[0021] As a configuration of a nonaqueous electrolyte rechargeable battery, besides the combination of an above-mentioned positive electrode, a negative electrode and a spiral electrode object with a separator, and nonaqueous electrolyte, you may be the combination of a spiral electrode object with a positive electrode, a negative electrode, and an organic solid electrolyte, and nonaqueous electrolyte, and it is not especially limited in this invention.

[0022]
[Effect of the Invention] As stated above, the nonaqueous electrolyte rechargeable battery which becomes this invention can make actuation of a relief valve more reliable even in the large large-sized cell of an electrode surface product while being able to apply inside a cell the internal pressure of the cell attracted by rapid generation of heat by the internal short circuit to homogeneity, even when the unexpected emergency situation arises. In addition, it excels in space efficiency and, moreover, a cheap high capacity nonaqueous electrolyte rechargeable battery can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the cross section of the cylindrical shape nonaqueous electrolyte rechargeable battery concerning one example which becomes this invention.

[Description of Notations]

- 1 Cylindrical Shape Nonaqueous Electrolyte Rechargeable Battery
- 2 Electrode Object
- 3 Positive-Electrode Plate
- 4 Negative-Electrode Plate
- 5 Separator
- 7 Positive-Electrode Lead
- 8 Negative-Electrode Lead
- 10 Cell Container
- 11 Cell Lid
- 20 Pressure Roll Off
- 30 Winding Core
- 31 Positive-Electrode Terminal
- 32 Negative-Electrode Terminal
- 40 Relief Valve

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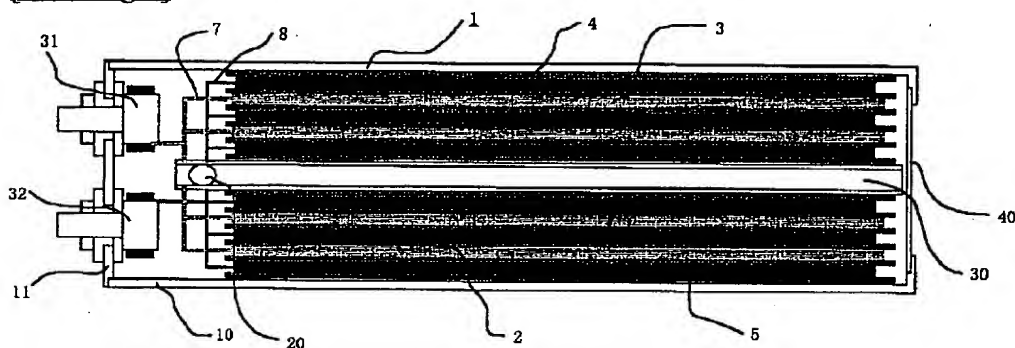
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DRAWINGS

[Drawing 1]



[Translation done.]

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